

## AUSTRALIAN ACANTHOCEPHALA

No. 7

By T. HARVEY JOHNSTON and S. J. EDMONDS \*

[Read 13 May 1948]

(Fig. 1-20)

The three species of echinorhynchs described in this paper were collected from birds. One (*Centrorhynchus horridus* Linst.) had been previously recorded from the Bismarck Archipelago; the second, *Polymorphus biziurae*, is described as new, and an account is given of its larval stage; the third, *Gordiorhynchus hylae*, is considered to be the adult stage of a larva described many years ago (Johnston 1912; 1914) from Eastern Australian frogs.

Parasite	Host	Locality
<i>Centrorhynchus horridus</i> (Linst.)	<i>Halcyon sanctus</i> - -	Qld., N.S.W.
<i>Polymorphus biziurae</i> n. sp.	- <i>Biziura lobata</i> - -	Sth. Aust.
larval stage - - -	- <i>Cherax destructor</i> - -	Sth. Aust.
<i>Gordiorhynchus hylae</i> (Johnst.)	- <i>Podargus strigoides</i> -	Sth. Aust.
larval stage - - -	- <i>Limnodynastes dorsalis</i> -	Sth. Aust.
" " - - -	- <i>Hyla aurea</i> - - -	Sth. Aust., N.S.W.
" " - - -	- <i>Hyla caerulea</i> - -	Qld.

We wish to acknowledge our indebtedness to Professor J. B. Cleland of Adelaide; Mr. J. T. Gray of Orroroon, S. Aust.; Messrs. G. G. and B. Jaensch of Tailem Bend; and Mr. I. Ellis of Murray Bridge, for assistance in obtaining material.

Type and typical specimens have been deposited in the South Australian Museum. No. 6 of this series of papers was published by us in the Records of the South Australian Museum, 8, (4), 1947, 555-562.

## CENTRORHYNCHUS HORRIDUS (von Linstow, 1897)

Some material collected in 1919 by Dr. J. B. Cleland from the intestine of *Halcyon sanctus* at Stradbroke Island, Queensland, was examined by us and found to contain one male, four females and some fragments of this species. The specimens were not in a good state of preservation and have not cleared well. They are long and cylindrical and taper slightly towards the posterior extremity. The male is 9.3 mm. long and 0.8 mm. wide and the maximum dimensions of the females are, length 13.5 mm. and breadth 1.0 mm. The proboscis of the best preserved specimen is 0.55 mm. in length. It consists anteriorly of a cylindrical portion, 0.27 mm. long and 0.16 mm. wide, and posteriorly of a region 0.28 mm. long, the diameter of which gradually increases as it approaches the body of the worm. The maximum width of this posterior portion is 0.28 mm. We have not been able to determine the number of longitudinal rows of hooks. Each row, however, seems to consist of about 14 or 15 hooks. Their shape and arrangement resemble closely those of *C. horridus* given by Meyer (1932, fig. 102). The proboscis sheath is about 0.8 mm. long, is double-walled, and arises at about the level of the seventh or eighth hook. Two ellipsoidal testes of length 0.55-0.60 mm. and maximum width 0.35 mm. are situated in tandem in the anterior third of the male. The cement glands are long, cylindrical and pressed

\* University of Adelaide.

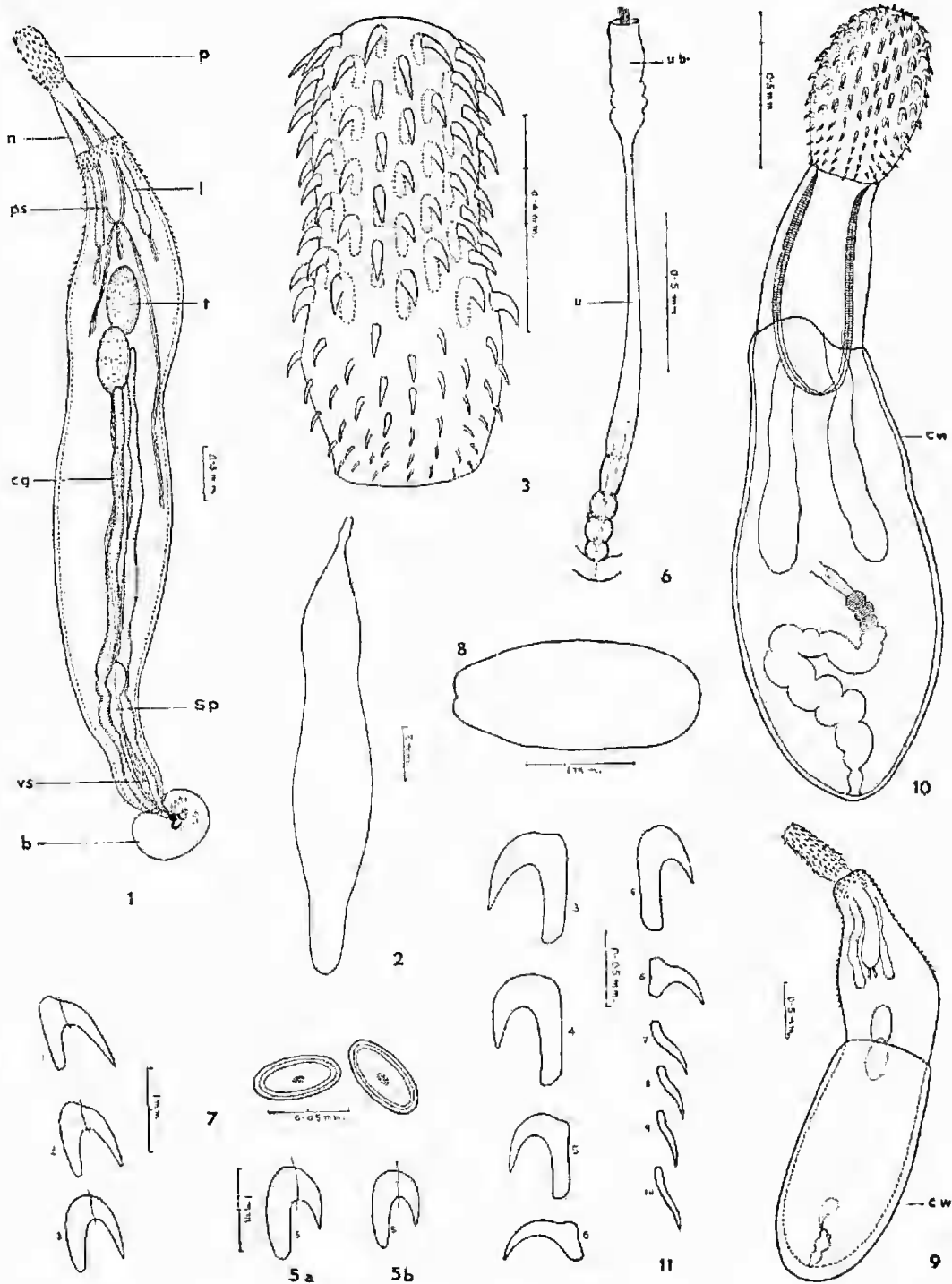


Fig. 1-9 *Polymorphus biziurac*

1, adult male; 2, adult female; 3, proboscis; 4, proboscis hooks 1-3 of each row, from large female; 5a, hook 5, from large female; 5b, hook 5 from small male; 6 female genitalia; 7 eggs; 8 cyst from *Cherax destructor*; 9, everted male larva.

Fig. 10-11 *Gordiorhynchus hylae*

10, everted female larva from *Limnodymastes dorsalis*; 11, some books from larvae. References to lettering—b, bursa; cg, cement gland; cw, cyst wall; fo, female aperture; gg, genital gland cell; la, lacunar vessel; l, lemniscus; n, neck; p, proboscis; ps, proboscis sheath; sph, sphincter; sp, Saeffigen's pouch; t, testes; u, uterus; ub, uterine bell; vd, vas deferens; vs, vesicula seminalis.

together. The male opening is terminal. Ovarial masses varying in diameter from 0.10 to 0.22 mm. are present in the females. The body cavity of two of the females contains eggs, which are 36-44  $\mu$  long and 14-18  $\mu$  wide. We have not been able to determine whether they are mature.

Our specimens agree closely in most details with the description of *C. horridus* as given by Marval (1905) and Meyer (1932, 119-20). In their census of Australian Acanthocephala, Johnston and Deland (1929, 149) reported that *Echinorhynchus* sp. probably *E. horridus*, had been collected from *Haleyon sanctus* in New South Wales by the senior author (Johnston 1910, 105). Travassos (1926, 58) transferred the species to *Prosthorhynchus*, and Meyer (1932, 119) to *Centrarhynchus*.

### *Polymorphus biziurae* n. sp.

Fig. 1-9

About fifty specimens of this parasite in stages of development ranging from larvae with cyst wall still attached, to adults, have been collected on different occasions from musk ducks, *Biziura lobata*, obtained for us by G. G. and B. Jaensch, and L. Ellis at Taillem Bend on the River Murray. The males and the younger females are white, but the mature females are orange in colour. Both the males and females are constricted slightly in the anterior part of the body.

#### ADULTS

The length of the males is 6.2-9.0 mm. and that of the egg-bearing females 11.1-18.2 mm. The maximum width of the males is 0.8-1.4 mm. and that of the females 1.7-2.8 mm. The proboscis is cylindrical and in most cases it is slightly swollen in the posterior half. The proboscis of the specimens in our collection shows considerable variation in length, viz., 0.64-0.94 mm., that of the female in most cases being larger than that of the male. The maximum width of the proboscis is 0.26-0.35 mm. It is armed with 21-22 longitudinal rows, each of 9-11 hooks. The anterior five hooks of each row bear well-developed, posteriorly-directed rooting processes. The shape and size of some of these hooks in the case of a large female are shown in fig. 4 and 5a. Fig. 5a and 5b show the relative sizes of identically situated hooks from a large female and small male respectively. Between the proboscis and the body there is an unarmed neck which, when fully extended, is 0.6-0.9 mm. long. In most of the specimens the neck is wholly or partly retracted. The anterior part of the body immediately behind the neck in both sexes bears a large number of minute spines. The proboscis sheath is double-walled and arises in the anterior portion of the neck. Its length is 1.3-2.3 mm. There are two lemnisci which appear to be from one to one and half times as long as the proboscis sheath. The body wall is thick and contains numerous small nuclei. The lacunar system consists of two longitudinal collecting vessels from which smaller anastomosing vessels arise.

Two ellipsoidal testes of approximately equal size lie in the anterior half of the male. Their length is 0.60-0.87 mm., and their maximum breadth 0.28-0.35 mm. Four long tubular cement glands arise near the level of the posterior testis. The bursa bears two anteriorly directed diverticula and the male opening is terminal.

The structure of the female reproductive organ is shown in fig. 6. The uterine bell is 0.35-0.43 mm. long and the uterus proper 1.1-1.6 mm. long. The vaginal sphincter is double and a gland cell surrounding the female aperture is in some cases very conspicuous, so that the vaginal complex then appears to consist of three bulbs. The female opening is terminal. Ripe eggs mounted in balsam are 58-65  $\mu$  long and 29-34  $\mu$  wide and are without polar prolongations.

We regard this parasite as a new species of the genus *Polymorphus*. It resembles rather closely *P. cucullatus* Van Cleave and Starrett (1940, 349) and *P. mutabilis* (Rudolphi 1819). It differs from the former in the number of proboscis hooks and from the latter in the size and the shape of its egg.

#### ENCYSTED FORM, JUVENILES AND INTERMEDIATE HOST

Our material from *B. lobata* contains a number of everted larvae of *P. biziuræ* with cyst wall still attached to the parasite. Measurements made on one male and one female larva after mounting in balsam are given below. Fig. 9 shows an everted male.

We have on a number of occasions obtained specimens of the yabbie, *Cherax destructor*, and yabbie fragments from the stomach and intestine of *B. lobata*. From some of these yabbies and fragments we have dissected out *Polymorphus* cysts. Our records show that from yabbies in the stomach and intestine of *B. lobata* or from those collected in the swamps at Tailm Bend, we obtained in October 1938, two *Polymorphus* cysts; October 1939, two; December 1941, one; March 1942, one; and March 1948, one. Measurements made of these cysts mounted in balsam show them to be the same as those cyst walls attached to the everted larvae of *P. biziuræ* in the intestine of *B. lobata*. This evidence indicates that the yabbie, *Cherax destructor*, is the intermediate host of *P. biziuræ*, the adult form of which occurs in the musk duck, *Biziura lobata*.

An attempt to infect a yabbie with the eggs of *P. biziuræ* carried out in the aquarium of the Zoology Department of the University of Adelaide gave negative results. Perhaps the eggs of the parasite after laying require a period for further development before becoming infective.

Confirmatory evidence, however, that *Cherax destructor* is the intermediate host of *P. biziuræ* comes from the following facts. At Tailm Bend in April 1947, larvae of *P. biziuræ* along with yabbies were obtained from the stomach of the cormorant, *Microcarbo melanoleucus*. Five larvae with everted proboscis were also obtained from the rectum of this bird. At the same locality in December 1947 one cyst of *P. biziuræ* along with shrimp and yabbie fragments was found in the gizzard of the spoon-bill, *Platalea flavipes*, and three larvae with fully everted proboscis were found in the lower intestine of the bird. The cormorant and the spoon-bill seem to be unsuitable as final hosts for this parasite, since the juveniles found in the rectum of these birds had not undergone any development beyond that seen in the cysts from the yabbie, although the proboscis had become everted.

The following table gives the measurements (in millimetres) made on the larvae from different birds and on the cysts contained in the yabbie.

	Cyst in <i>Cherax destructor</i>	Everted larvae from intestine of <i>Biziura lobata</i>		Everted larvae from rectum of <i>Microcarbo melanoleucus</i>		Everted larvae from rectum of <i>Platalea flavipes</i>	
		male	female	male	female	male	female
Cyst membrane:							
length - - -	2.2 - 2.4mm.	2.4mm.	2.2mm.	2.2mm.	2.0mm.	2.1mm.	1.9mm.
breadth - - -	0.96 - 1.1	0.90	0.89	0.94	0.96	0.92	0.88
Length of worm		4.4	4.9	4.4	3.6	4.2	4.8
Maximum breadth		0.8	0.7	1.0	1.1	0.7	0.9
Proboscis, length		0.65	0.80	0.67	0.75	0.69	0.81
Testes, length -		0.4		0.42		0.35	
Testes, breadth -		0.2		0.2		0.2	

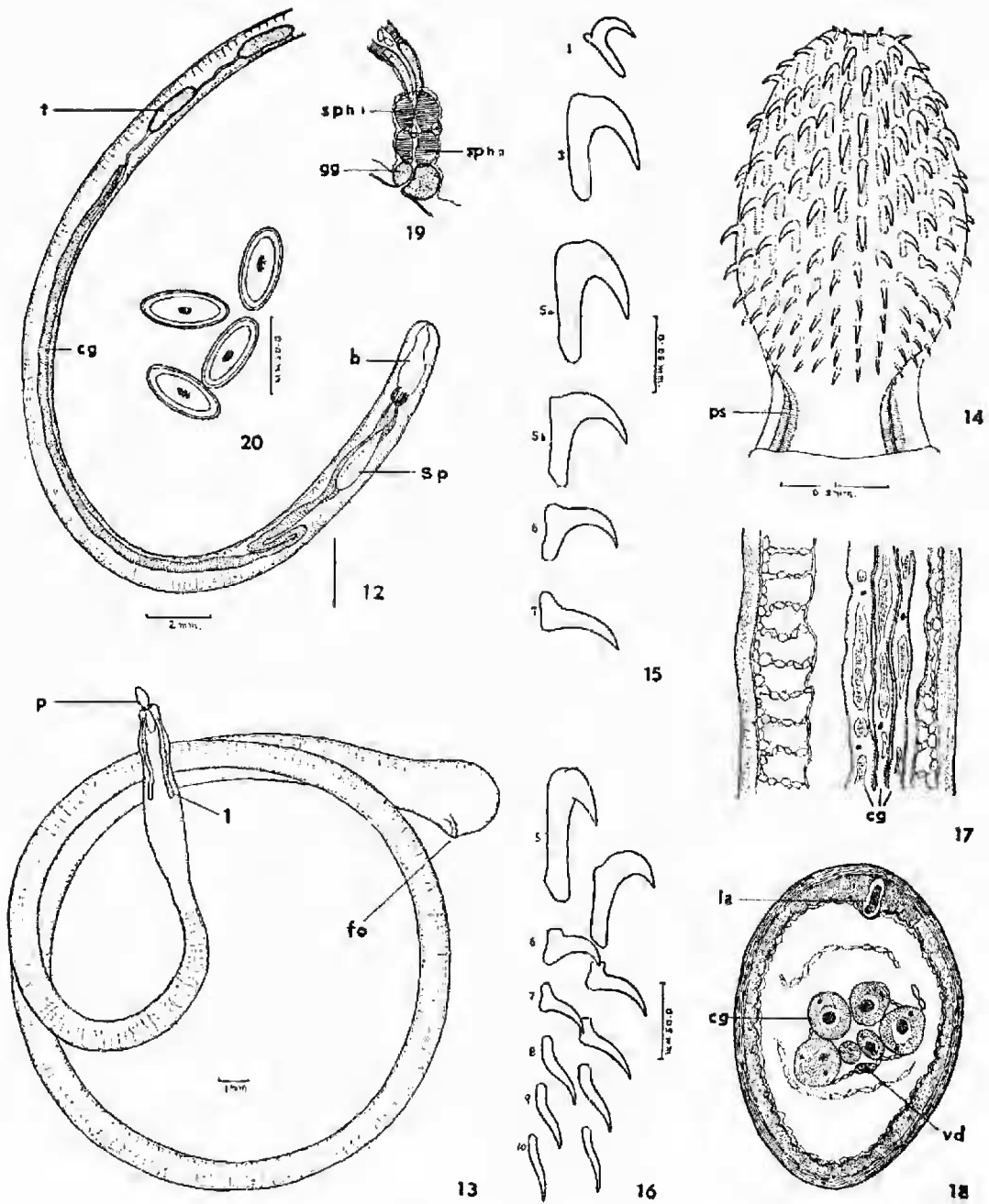


Fig. 12-20 *Gordiorhynchus hylae*

12, portion of male; 13, adult female; 14, proboscis; 15, some proboscis hooks from adult female; 16, proboscis hooks showing changes in form of the rooting processes; 17, L.S. male, showing inner pseudo-segmentation; 18, T.S. male showing six cement glands; 19, vaginal complex; 20, eggs.



The cysts from the crustacean may have one end slightly wider than the other and both extremities have a wide shallow depression, one of which contains the genital aperture. These larvae evert the proboscis if placed in fresh water. We have not found these larvae in any other animal living in the swamps.

*GORDIORHYNCHUS HYLAE* (Johnston) Johnston and Edmonds  
Fig. 10-20

Four female and two male specimens of this echinorhynch were found in the intestine of *Podargus strigoides* at Ororoo, South Australia, in May 1939, by Mr. J. T. Gray. The worms are long, cylindrical and widest in the posterior region. Both sexes exhibit inner pseudo-segmentation of the type shown by *Gordiorhynchus clitorideus* Meyer (1930). The posterior extremity of the female is much swollen and rounded, and near the female genital opening there is a small epidermal protuberance. The body of both sexes is smooth.

The length of the males is 48-52 mm., and the maximum width 1.1-1.3 mm. The length of the females is 56-81 mm., and the maximum breadth 1.4-1.8 mm. measured just in front of the rounded bulb at the posterior extremity of the worm. The diameter of this bulb is 1.9-2.5 mm. The proboscis is small in comparison with the length of the parasite. Its length is 0.55-0.65 mm., and its maximum breadth 0.37-0.43 mm. Its width at the anterior extremity is 0.12-0.13 mm. Between the proboscis and the body there is a short unarmed neck 0.10-0.15 mm. long and 0.30 mm. wide. In the largest female the total length of the proboscis and neck is 0.75 mm. The proboscis is armed with 26-28 longitudinal rows, each of ten hooks. The first five hooks of each row are largest and possess well-developed posteriorly-directed rooting processes. These rooting processes of hooks six and seven are much reduced and an anteriorly-directed process appears. In hooks eight, nine and ten the processes are anteriorly directed. Fig. 15 and 16 show the general arrangement and size of some of the proboscis hooks. Occasionally a slight variation in the shape and arrangement of the hooks in a row is observable, e.g., fig. 15, hook 5 a. The proboscis sheath is double-walled and is inserted at the level of the tenth hook. The point of insertion of the sheath, therefore, does not divide the armed portion of the proboscis into two parts as is the case with the genera *Centrorhynchus* Lühe 1922 and *Gordiorhynchus* Meyer 1931. The width of the outer wall of the sheath is about 20  $\mu$ , and its length 1.1-1.6 mm. In one male specimen the sheath is very much constricted near its middle. The lemnisci are about 3-4 mm. long. There is one long and well-developed lacunar vessel from which anastomosing vessels arise. The body wall is thick and consists of an outer epidermal layer surrounding layers of circular and longitudinal muscle tissue. No nuclei were noticed in it. Transverse and longitudinal sections show that in both sexes an inner pseudo-segmentation is present similar to that occurring in the female of *G. clitorideus*. The structure of the pseudo-segmentation of the male is shown in fig. 17.

Two long and ellipsoidal testes of approximately equal length lie in tandem in the anterior half of the worm. Their dimensions are length 1.2-2.2 mm., and maximum breadth 0.42-0.60 mm. There appear to be six tubular cement glands pressed closely together. Four of these arise near the posterior testes. The cement reservoirs are long. The bursa bears two anteriorly directed diverticula and the male opening is terminal.

All the females in our collection are densely packed with eggs and ovarian masses, and we have not been able to trace completely the female genitalia. The vaginal complex consists of three bulbs, and the genital opening, marked by a swelling of the epidermis, is sub-terminal. As is the case in *G. clitorideus* the

ovarial masses develop in the larger, presumably dorsal, segments. Ripe eggs are ellipsoidal and when mounted in balsam are 54-60  $\mu$  long and 24-28  $\mu$  wide. They are without polar prolongations. The nucleus in some of the eggs seems to be dumb-bell-shaped.

#### *Systematic Position*

The genus, *Gordiorhynchus*, as conceived by Meyer (1931, 120-22), consists of Centrorhynchinae with inner pseudo-segmentation in the female and with an appendix near the female aperture. The sub-family, Centrorhynchinae Meyer 1931, consists of these Polymorphidae in which the insertion of the proboscis sheath divides the proboscis into two parts. Both the male and female specimens in our material show inner pseudo-segmentation, and the females possess a structure near the genital opening which seems to correspond to the appendix of *G. clitorideus*. Internal pseudo-segmentation in male specimens of the genus, *Gordiorhynchus*, has already been recorded in the case of *G. falconis* Johnston and Best (1943, 229). The proboscis of the parasites in our collection, however, is not divided into two portions by the proboscis sheath. The double-walled sheath in each of our specimens arises at the level of, or just posterior to, the level of the tenth hook of each row. We consider that the conception of the genus, *Gordiorhynchus*, should be widened to include echinorhynchs with inner pseudo-segmentation in one or both sexes.

#### *Encysted Form*

From time to time during class dissections in Adelaide University white acanthocephalan cysts have been obtained from the mesentery of the frogs, *Limnodynastes dorsalis* and *Hyla aurea*. The presence of these cysts in *H. aurea* in New South Wales and *H. caerulea* in Brisbane has already been reported by the senior author (Johnston 1912, 84-85; 1914, 83-84), who described the species (1914) as *Echinorhynchus hylae*. Meyer (1932, 252) placed the species amongst Acanthocephala incertae sedis. We have found that in many cases the proboscis of the encysted parasite can be made to evert if the cyst is freed from the mesentery and placed in fresh water. Fig. 10 shows a female specimen in the everted condition. The size of the proboscis and the shape, size and arrangement of the proboscis hooks show that this parasite is the encysted form of the worm which we have obtained from *Podargus strigoides*. The shape and size of some of the proboscis hooks of the larvae are shown in fig. 11 and are drawn to the same scale as those of the adult shown in fig. 15 and 16. The following measurements have been made on the cysts and the everted larvae. Length of cyst 1.38-1.70 mm., and maximum breadth 0.45-0.63 mm. Length of proboscis 0.58-0.63 mm., and maximum width 0.35-0.40 mm., and armed with 28 longitudinal rows each of ten hooks. Length of larvae 2.1-3.0 mm., and maximum width 0.45-0.65 mm.

It seems to us probable that the adult stage will be found in other nocturnal predatory birds, since *Podargus* is not a common bird in the localities from which infected frogs were obtained. Travassos (1926, 43) and Meyer (1932, 117) mentioned that the larva of *Centrorhynchus tumidulus* occurred in certain frogs and snakes.

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